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Goat moths (Lepidoptera: Cossidae) of the Hanford Site and Hanford National Monument, Washington State

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Abstract. Three species of goat moths are recorded at the Hanford Nuclear Site and Hanford National Monument in south central Washington State. They are: *Comadia bertholdi* (Grote 1880), *Givira cornelia* (Neumoegen & Dyar 1893), and *Prionoxystus robiniae* (Peck 1818). The general habitat of the Hanford area is shrub-steppe but there are extensive areas of sand dune as well as limited riparian habitat. These are the first Washington records for *C. bertholdi* and *G. cornelia*. In addition, *Comadia bertholdi* also is first recorded here from Yakima County, Washington, 81 km west of the Hanford Site. Flight period dates are presented for all collections.

Key Words. goat moths, carpenter moths, Hanford, Washington State, new state records.

Located in the Pasco Basin of the of the Columbia Plateau, in south central Washington State, the Hanford Site comprises approximately 1450 km^2 of relatively undisturbed, predominately shrub-steppe habitat. Originally acquired by the United States Federal government as a site for the production of plutonium to be used in weapons production, the site is currently administered by the Department of Energy for nuclear waste management, environmental restoration, and research and development. The Site was closed to the general public in 1943. From an ecological standpoint, the placing of such a large tract of land virtually off limits to public access for over half a century has preserved a shrub-steppe ecosystem that has otherwise changed radically throughout the remainder of the Columbia Plateau and the Great Basin (Zack 1998).

The Hanford Site consists of a steeply rising, northeast-facing slope (Rattlesnake Ridge - 1150m) and extensive flats that slope gently from 500 to 150 m before they reach the Columbia River. Vegetation is primarily a sagebrush/Sandberg's bluegrass-cheatgrass type; the general habitat is referred to as shrub-steppe (Daubenmire 1970). Several small, permanent springs with associated riparian areas are found in the southeast portion of the Site and riparian areas border the Columbia River that form the eastern and northern boundaries of the Site. For a discussion of the plants of Hanford, including all sites examined in this study, see Sackschewsky and Downs (2001). Climate at Hanford is best characterized as semi-arid with hot and dry summers and cold winters. Precipitation ranges from 30–35 cm at the crest of Rattlesnake Ridge to less than 12 cm in central Hanford and along the Columbia River. Temperatures range from an average of 3°C in January to 33°C in July; temperatures of 32°C or above occur an average of 56 day per year (ERDA 1975).

Goat or carpenter moths (Cossidae) are primarily tropical in distribution with a few species occurring as far north as Washington State and British Columbia in

western North America. There are approximately 50 species in North America with most of those occurring in the southwestern states (Powell & Opler 2009). The larvae bore into the branches and trunks of trees and shrubs and some, such as the carpenterworm *Prionoxystus robiniae* (Peck) can be significant pests.

Methods and Materials

All specimens reported in this paper were collected at ''black'' light bucket or mercury vapor light traps. Bucket traps consisted of five gallon, white plastic buckets with a metal funnel over the opening. A 15 watt ''black,'' florescent lamp (BioQuip products, Rancho Dominquez, CA) was hung vertically just over the funnel opening. The bucket was placed on the surface of the soil and the lamp was supported by a wooden pole that was driven into the soil. The height of the bulb at its highest point was approximately one meter above the surface of the soil. Ethyl acetate was used as a killing agent in bucket traps. Traps were set-up approximately one hour before dusk and moths collected from the traps just after dawn. A second method of survey involved the use of a 160 watt mercury vapor light (BioQuip Products, Rancho Dominquez, CA) that was supported with a tripod approximately 1.5 m from the soil surface over a set of white bed sheets. Moths were handpicked from the sheets and placed into individual glass or plastic vials and returned to the laboratory for processing. Both black lights and mercury vapor lamps were turned on approximately 30 min before dusk. Mercury vapor lamps were operated for varying amounts of time into the night while black light bucket traps were operated until dawn. All goat moths, collected by either means, were processed and recorded. During the seven years of this study, traps of one variation or another were used from as early as 10 March through as late as 3 November (1995–2000) on the Hanford Site (Benton Co.) and from 11 April through 1 November 2002 and 14 March through 11 April 2003 on the Hanford National Monument (Grant Co.). Consistency of trapping was irregular on the Hanford Site but during the seven years, 151 collecting nights were conducted. Collecting during the one-year study at the Monument was conducted weekly during the period of time delineated above. Collecting sites were primarily shrub-steppe in nature but habitats within the general shrub-steppe environment included extensive areas of sand dunes, riparian areas around permanent springs, the riparian area surrounding an alkaline pond, and wet draws, and the abandoned town site of Hanford that was situated along the Columbia River. The draws and old Hanford town site contained a variety of trees including willow (*Salix* spp., Salicaceae) and poplar (*Populus* spp., Salicaceae).

Results and Discussion

Three species of goat moths were taken at the Hanford Site and Hanford National Monument.

Comadia bertholdi (Grote), 1880 - The genus *Comadia* was revised by Brown (1976) who records the nominate subspecies, *C. bertholdi bertholdi*, which is the taxon that we find in Washington, from California, Colorado, and Wyoming. Powell & Opler (2009) state that the flight period of the moth, without designating a subspecies, in Colorado is June and July, which agrees with our findings at Hanford of first adults in mid-June and the latest collections in mid-July (Table 1). Brown (1976) lists a flight period of June through August. Rivers (1897) found larvae of the congeneric species, *C. intrusa* Barnes and Benjamin, 1923, feeding in a species of

Table 1. Goat Moth (Lepidoptera: Cossidae) collections at the Hanford Site, south central Washington State. BL = 15 watt fluorescent "black" light bulbs; MV = 160 watt mercury vapor light fixture.

Species	Date	Number moths collected	Habitat type	Light trap type
Comadia bertholdi (Grote)				
	14 June 2002	2	Shrub-steppe	BL
	14 June 2002	1	Sand dunes	BL
	20 June 1997	3	Riparian	MV
	28 June 2002	1	Shrub-steppe	BL
	5 July 2002	3	Shrub-steppe	BL
	16 July 1997	3	Shrub-steppe/trees	MV
Givira cornelia (Neumoegen and Dyar)				
	30 May 1997	7	Shrub-steppe/trees	MV
	7 June 1996	22	Sand dunes	MV
	14 June 2002	4	Shrub-steppe	BL
	14 June 2002	7	Sand dunes	BL
	16 June 1997	5	Shrub-steppe/trees	MV
	18 June 1996	1	Sand dunes	MV
	28 June 1995	2	Sand dunes	MV
	29 June 1995	9	Sand dunes	MV
	5 July 2002	1	Shrub-steppe	BL
Prionoxystus robiniae (Peck)				
	14 June 2002	3	Shrub-steppe	BL
	16 June 2002	1	Shrub-steppe/trees	MV
	18 June 1998	1	Riparian/trees	MV
	28 June 2002	4	Shrub-steppe	BL
	5 July 2002	6	Shrub-steppe	BL
	12 July 1995	2	Riparian/trees	MV
	19 July 2002	2	Shrub-steppe	BL
	24 July 2002	1	Riparian/trees	MV

lupine; lupines are common at the Hanford Site at moth collecting locations. During April through June of 2002, we searched lupines in the vicinity of each light trap on five different trapping periods (April through August) but did not locate cossid larvae.

At Hanford, *C. bertholdi* was taken at both black light and mercury vapor traps (Table 1). It was found in a number of different general habitat types including typical shrub-steppe as well as a single specimen from sand dunes and several from a riparian area. To the best of our knowledge, these are the first records of the moth from Washington State. *Comadia bertholdi* probably occurs throughout the general Great Basin with the Hanford area, or similar areas just north of Hanford being its northern limit. In other survey work in Washington State, we found a single specimen from Yakima County, near Parker, that was taken on 6 June 2002. This site is approximately 81 km west of the Hanford locations. Specimens have also been collected in Grant County on Highway 243, 1.5 mi North of Wanapum Dam (Lars Crabo, personal collection).

Givira cornelia (Neumoegen & Dyar), 1893 - Of the 15 or more species of *Givira* that occur in the western United States, most are primarily distributed in the southwestern states (Powell & Opler 2009). *Givira cornelia* was reported from Colorado by Barnes & McDunnough 1911. One *Givira* species, *G. lotta* Barnes &

McDunnough, 1911, is a minor pest and mines the outer bark at the base of the trunks of ponderosa pines (Furniss & Carolin 1977). Johnson (2003) and Cannings & Scudder (2008) record the species for Utah and British Columbia, respectively.

At Hanford we collected specimens from 30 May through 5 July at both black light and mercury vapor light traps where it was most common in the sand dune habitat (Table 1). Nothing appears to be known concerning the biology of this species, but it would not appear to feed on conifers at Hanford, due to their absence. Given that it dominantly was taken in the sand dunes habitat, the larvae may be associated with a sand dunes plant. Specimens have also been collected in Grant County on Highway 243, 1.5 mi North of Wanapum Dam (Lars Crabo, personal communication).

Prionoxystus robiniae (Peck), 1818 - The carpenterworm moth, *P. robiniae* is widely distributed throughout the United States and southeastern Canada (Solomon 1995). In the western United States, Powell & Opler (2009) record it from Colorado, Utah, Nevada, California, and Arizona with flight periods from the end of January through July with a peak in April/May. The species probably occurs in all of the western states. Baker (1972), Furniss & Carolin (1977), and Solomon (1995) discuss the economic significance of carpenterworm larvae as well as present biological notes. The carpenterworm moth can be of some economic importance as the larvae, which may take up to three years to complete development, create large burrows that can weaken trees and cause them to fall during high winds. Pupae overwinter in their burrows and emerge in the spring. In the Western United States, depending on location, adults fly from mid-winter to mid- to late-summer (Furniss & Carolin 1977, Powell & Opler 2009). With the creation of large, commercial poplar plantations in Oregon and Washington, this moth may have significant economic consequences to this industry.

At Hanford, adults were collected at black light and mercury vapor light traps from mid-June through the 24th of July (Table 1). Specimens were taken in shrub-steppe and in riparian areas but all of these areas were within visual range of a stand of poplar or willow trees that were probably serving as larval hosts.

The Hanford Site and Monument represent some of the best examples of undisturbed shrub-steppe habitat remaining in the western United States. Included are extensive sand dunes. While *C. bertholdi* is geographically widely distributed in the inland Pacific Northwest and southern British Columbia, the only specimens that we obtained in extensive survey activities throughout eastern Washington are the one individual from Yakima County and those from Hanford. The same is true for *G. cornelia*, a species of which we have colleted no other specimens except for those at Hanford. This latter species may be restricted to the sand dunes habitat. *Prionoxystus robiniae* is widespread throughout southeastern Washington where appropriate hosts such as poplar and willow are found. The planting of poplar plantations for commercial purposes is certainly increasing the abundance and range of the species in the basin regions of Washington and Oregon.

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